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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/212,726	12/15/1998	KLAUS F. SCHUEGRAF	M122-1098	7984

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EXAMINER	
KIELIN, ERIK J	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 04/22/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/212,726	SCHUEGRAF, KLAUS F.	
	Examiner	Art Unit	
	Erik Kielin	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 February 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *60-64,66-68 and 70* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *60-64,66-68 and 70* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 13 February 2004 has been entered.

Claim Rejections - 35 USC § 112

2. Claims 60-64, 66-68 and 70 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The specification does not provide support for the negative limitation, "without feeding added ozone into the chemical vapor deposition reactor." The specification wholly fails to address ozone. The evidence indicates that Applicant did not have possession of knowledge as to how ozone may or may not impact the instant process either positively or negatively. Accordingly, this new limitation amounts to new matter.

In the interest of customer service, should Applicant wish to eliminate ozone in the reaction gas mixture, the proper course of action is to recite "consisting of" in the preamble and

include all limitations in a single claim **that are supported by the instant disclosure** --not to use unsupported negative limitations.

Additionally, the specification does not support the limitations "to directly deposit SiO_2" or "the SiO_2 being formed during the directly depositing." The evidence of record indicates that silanol, at best, $Si(OH)_4$ will deposited --not SiO_2-- since the specification indicates that H_2O and H_2O_2 are used as oxidants of the TEOS. Moreover, the specification is only directed to **reduction** of intermediates associated with the precursor directly in other words, mono-, di- and tri-ethoxy silanols --not elimination. Further in this regard, the specification indicates that the problem with the prior art decomposition of TEOS is that it is difficult for the **intermediates** to reach the bottom of high aspect ratio openings thereby providing poor conformality. In this regard, the specification states, in pertinent part at p. 2, line 9 to p. 3, line 13,

> "Typically, however, **intermediates** are formed in the above reaction which include di-ethoxysilane ($Si(OC_2H_5)_2(OH)_2$) and tri-ethoxysilane ($Si(OC_2H_5)_3OH$). Further, other reaction by-products are formed..."
>
> "One source of inadequate conformality of SiO_2 on a substrate surface is premature formation of **undesirable intermediates which react to form SiO_2 at higher topographical elevations** on a substrate surface. Consequently, such **intermediates never reach the bottom** of a particular substrate feature, such as trench 12 of Fig. 2, **so that lesser degrees of SiO_2 are formed thereon**." (Emphasis added.)

It would appear, then, that the solution to the problem in the instant invention would intend to get such "intermediates" to reach the bottom of the openings not to directly deposit SiO_2. Moreover, the specification fails to support the direct formation of SiO_2 in the gas phase from the intermediates formed prior to deposition on the substrate.

3. Claims 60-64, 66-68 and 70 are rejected under 35 U.S.C. 112, first paragraph, as based on a disclosure which is not enabling. All of the parameters required to achieve a deposition rate of 7000 Å/min, as disclosed in the instant specification at page 11, lines 9-20, critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure. See *In re Mayhew*, 527 F.2d 1229, 188 USPQ 356 (CCPA 1976).

The instant invention requires each of the limitations recited at page 11, lines 9-20 of the specification to achieve a deposition rate of about 7000 Å/min. There exists no other means disclosed in the specification to achieve this deposition rate. Accordingly, critical features necessary to obtain the deposition have been omitted from the claims, rendering the claims not enabled.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 60-64, 66-68, and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,710,079 (**Sukharev**) in view of US 5,356,722 (**Nguyen** et al.) and considered with **Wolf**, et al. Silicon Processing for the VLSI Era, Vol. 1-Process Technology, Lattice Press: Sunset Beach CA, 1986, pp. 166-167, for a showing of inherency only.

Regarding claim 60, **Sukharev** discloses a semiconductor processing method of depositing a SiO_2 layer comprising,

providing a substrate **101** within a cold-wall, chemical vapor deposition (CVD) reactor **300** (Figs. 1 and 3);

feeding a gaseous silicon precursor (TEOS for example) into the CVD reactor (col. 3, lines 50-65);

feeding gaseous H_2O_2 into the CVD reactor (col. 3, lines 50-65); and

utilizing the silicon precursor, directly depositing a layer of SiO_2 over a surface of the substrate the SiO_2 being formed during the direct depositing (col. 3, lines 50-65).

While **Sukharev** uses ozone, Applicant fails to provide support for the negative limitation of without feeding ozone into the CVD chamber, accordingly the reference of **Sukharev** still reads on the claimed features for which there exists support in the specification.

It is seen to be inherent that the reactor of **Sukharev** is a cold-wall reactor, because the heating of the wafers is via the susceptor (Sukharev, col. 6, lines 24-31). **Wolf** at pages 166-167 indicates that when the heating comes from within the reaction chamber, that the reactor is called a "cold-wall" reactor, as compared to a "hot-wall" reactor wherein the heating elements are located external to the chamber.

Sukharev does not indicate that the deposition rate is about 7000 Å/min.

Nguyen discloses a CVD method of depositing a SiO_2 layer wherein the deposition rate is taught in one exemplary embodiment to be 7000 Å/min using TEOS and ozone between the temperatures of 350 °C to 450 °C (Nguyen col. 4, lines 51-65), while **Sukharev** uses a preferred temperature of 400 °C.

It would have been obvious for one of ordinary skill in the art, at the time of the invention to apply the deposition rate of **Nguyen** to that of **Sukharev** because **Nguyen** teaches that the

deposition rate is common in the art for directly depositing SiO_2. Moreover, the instant specification provides no indication that the deposition rate has anything to do with the object of (criticality of) the instant invention which, as indicated in the instant specification at page 4 is to prevent the formation of undesired reaction intermediates in the decomposition of the CVD precursor gases. Rather the instant specification teaches away from any criticality to the deposition rate indicating that it the exemplary result of the process conditions.

Regarding claim 61, **Sukharev** discloses that the gaseous precursors are independently fed into the CVD reactor (Fig. 2).

Regarding claim 62, **Sukharev** discloses that the precursors are necessarily fed into the CVD reactor simultaneously (col. 3, lines 55-59).

Regarding claim 63, **Sukharev** discloses that the gaseous H_2O_2 and the gaseous silicon precursor are comprised by a gaseous mixture that is fed into the chemical vapor deposition reactor (col. 3, lines 55-59).

Regarding claim 64, **Sukharev** discloses that gaseous H_2O is also fed into the CVD reactor (col. 3, lines 55-59).

Regarding claim 66, **Sukharev** shoes that the substrate **101** is shown to have a high aspect ratio and that the SiO_2 is conformally deposited, by definition, since the SiO_2 film "conforms" to the surface (Fig. 1).

Regarding claim 67, **Sukharev** discloses that the gaseous precursor may be at least TEOS (col. 3, lines 55-59).

Regarding claim 68, **Sukharev** discloses that the deposition temperature is preferably 400 °C (col. 6, lines 24-27).

Regarding claim 70, the prior art as explained above discloses all of the limitations of the instant invention, but does not teach the claimed concentration range of 5-15% H_2O_2. Instead, **Sukharev** discloses ranges of 0.5 to 3% H_2O and 0-3% H_2O_2. However, it has been held that choosing parameters within or near ranges taught by the prior art is *prima facie* obvious. See *In re Wertheim,* 541 F.2d 257, 191 USPQ 90 (CCPA 1976). See also *In re Huang*, 40 USPQ2d 1685, 1688(Fed. Cir. 1996)(claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). Therefore, it would have been obvious to choose a concentration with 5% and 15% because **Sukharev** discloses a range near the claimed range, according to the precedent set by *In re Wertheim or In re Huang.* Moreover, the concentration range for H_2O and/or H_2O_2 indicated in the specification to provide conditions "which are effective to reduce formation of undesired reaction intermediates" --the object of the invention-- range from less than 0.5% to 50% (see specification page 12, lines 3-13) and overlap those in **Sukharev**, e.g. 0.5 to 3% H_2O and 0-3% H_2O_2. Accordingly, there is nothing critical to the range now claimed in instant claim 70.

Response to Arguments

6. Applicant's arguments with respect to claims 60-64, 66-68 and 70 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 571-272-1693. The examiner can normally be reached on 9:00 - 19:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Erik Kielin
Primary Examiner
16 April 2004